IMMOBILIZATION OF α-AMYLASE (BAN) FOR SAGO STARCH HYDROLYSIS

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A report submitted in partial fulfillment
Of the requirements for the award
Of the degree of
Bachelor of Chemical Engineering

Faculty of Chemical Engineering & Natural Resources
University College of Engineering & Technology Malaysia

NOVEMBER 2006

DECLARATION

I declare that this thesis entitled "Immobilization of α-Amylase (BAN) for sago starch hydrolysis" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : KHAIRIL NAZUAN BIN MOHD

Date : 20 November 2006

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LIST OF ABBREVIATION

BAN	α-Amylase
pH	A measure of acidity
UGI	A multi-component reaction in organic chemistry
MTT	A laboratory test and a standard colorimetric assay
UV	Ultraviolet
NAD+	Nicotinamide adenine dinucleotide
NADH	Reduced form of NAD^+

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ABSTRACT

α-Amylase produced from *Baccilus Amyliquifaciens* (termamyl) was immobilized by entrapment in calcium alginate gel capsules and it was used repeatedly in batch processes of starch hydrolysis. The degree of starch degradation and operational stability of the immobilized system were increased by tailoring the characteristics of the capsules. Capsules prepared from 2% (w/v) sodium alginate and 5% (w/v) CaCl2 were suitable for up to 20 repeated uses, losing only 30% of their initial efficiency. These alginate/silica capsules carrying α-Amylase retained 90% of their initial efficiency after 20 starch hydrolysis batches and released more than 10,700 mg of reducing sugars during a processing period of 160 h.

ABSTRACT

α-Amylase daripada *Baccilus Amyliquifaciens* (termamyl) dipegunkan dengan cara pemerangkapan di dalam kapsul kalsium alginat dan digunakan berulang-kali dalam proses hidrolisis kanji. Darjah penurunan kanji dan kestabilan operasi dalam sistem hidrolisis ini telah dapat ditingkatkan dengan menala karekteristik kapsul tersebut. Kapsul yang disediakan dengan menggunakan 2% (w/v) sodium alginat dan 5% (w/v) $CaCl_2$ adalah sangat sesuai digunakan sehingga 20 kali dengan hanya kehilangan 30% daripada kecekapannya pada permulaan proses. Kapsul alginat ini yang mengandungi α-Amylase dapat mencapai 90% daripada kecekapan permulaannya selepas 20 kali proses hidrolisis kanji dilakukan dan dapat membebaskan lebih daripada 10,700 mg gula penurun sepanjang tempoh proses selama 160 jam.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Enzymes are protein molecules which serve to accelerate the chemical reactions of living cells (often by several orders of magnitude). Without enzymes, most biochemical reactions would be too slow to even carry out life processes. Enzymes display great specificity and are not permanently modified by their participation in reactions. Since they are not changed during the reactions, it is cost-effective to use them more than once. However, if the enzymes are in solution with the reactants and/or products it is difficult to separate them. Therefore, if they can be attached to the reactor in some way, they can be used again after the products have been removed. The term "immobilized" means unable to move or stationary. And that is exactly what an immobilized enzyme is: an enzyme that is physically attached to a solid support over which a substrate is passed and converted to product.

Enzymes can denature due to solvent effects and mechanical shear forces. Recovery of enzymes from reaction solutions and separation of the enzymes from substrates and products are in general very difficult. These problems can be successfully tackled by immobilization of the enzyme.

The main advantages of immobilized enzymes are:

- Easy separation from reaction mixture, providing the ability to control reaction times and minimize the enzymes lost in the product.

- Re-use of enzymes for many reaction cycles, lowering the total production cost of enzyme mediated reactions.

- Ability of enzymes to replace multiple standard chemical steps and provide enatomerically pure products.

1.2 Problem Statement

Enzymes are protein molecules which serve to accelerate the chemical reactions of living cells (often by several orders of magnitude). Without enzymes, most biochemical reactions would be too slow to even carry out life processes. Enzymes display great specificity and are not permanently modified by their participation in reactions. Since they are not changed during the reactions, it is cost-effective to use them more than once. However, if the enzymes are in solution with the reactants and/or products it is difficult to separate them. Therefore, if they can be attached to the reactor in some way, they can be used again after the products have been removed. The term "immobilized" means unable to move or stationary. And that is exactly what an immobilized enzyme is: an enzyme that is physically attached to a solid support over which a substrate is passed and converted to product

1.3 Objective

The objective of this research is to study the immobilization of α-amylase (BAN) and in alginate beads for sago starch hydrolysis.

1.4 Scope

1 To study the immobilization of α-amylase and amyloglucosidase for sago starch hydrolysis
2 To investigate the relationship between bead size and alginate concentration with alginate capsules
3 To optimize the capsule's characteristic.

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